Chemical Sterilization of Dysdercus cingulatus Fabr

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14. アカホシカメムシの化学不妊化

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Apholate, tepa 及び metepa のアカホシカメムシに対する効果を調べた。ペトリ皿の内面に1平方インチ当り 1.77 mg 及び 3.54 mg の試料を塗布し，羽化した成虫を入れた。不妊化剤処理した雄と正常雄のそれぞれと雌及び不妊剤処理した雌と雄を1対づつ相反交雑した。3種の不妊化剤のうち apholate がもっとも良い結果を示した。不妊化率は，処理時間と処理濃度に比例して高くなる。

また，雄は雌よりも不妊化されやすい。1平方インチ当り 3.54 mg の apholate を塗布したペトリ皿で雌雄とおに2時間処理した時に，100％の不妊化がみとめられた。

The elimination of insect population through chemosterilization has proved its superiority over the conventional methods of control by chemicals and is gaining wide favour and popularity. Since 1955, when the first successful attempt to eradicate the screw-worm, *Callitroga hominivorax* from Curacao island was made by Baumhover, *et. al.* (1955), there has been a spectacular development in this field of insect control and chemosterilants have proved their worth against a large number of insect species of public health and agricultural importance. Knipling (1959, 1966) discussing the ways and means of controlling populations through the sterile male release technique pointed out that complete elimination of insect population is possible if chemosterilization is integrated with other methods of control. Hedin, *et al.* (1964) studied the effect of apholate on the male boll weevil, *Anthonomus grandis* and found it to be an effective chemosterilant when given in diet or when the weevils were allowed to feed on cotton plants sprayed with aqueous solutions of apholate. The most promising method of testing chemosterilants against *Diabrotica balteata* consisted in exposing the adults to chemosterilant residues on glass surfaces (Creighton, *et al.*, 1966). Oral intake of apholate, tepa or metepa did not produce any satisfactory results whereas treatment with residual contact method caused 100% sterility in several instances. Adults of the cereal leaf beetle, *Oulema melanopus* were completely sterilized when both sexes were dipped in 0.05% aqueous solution of apholate for 30 seconds (Ezueh and Hoopingarner, 1967). Mason and Smith (1967) found that 0.5% and 1.0% apholate in bait and 0.5 % apholate applied as a contact spray or as a residue on glass effectively sterilized both sexes of *Drosophila melanogaster* and the same compound has been found to be an effective chemosterilant of *D. cingulatus* (Mustafa and Naidu, 1964).

So far a little is known regarding the comparative effectiveness of different chemosterilants against *Dysdercus cingulatus*. An attempt was, therefore, made to evaluate the efficiency of apholate, tepa and metepa as the chemosterilants for *D. cingulatus*.

Materials and Methods

Test insect and Chemicals : The bugs during the present studies were obtained from a normal strain of *D. cingulatus* that is being maintained in the laboratory since 1964. They were kept at a temperature of 29±1°C and were reared on water soaked cotton seeds.

The alkylating agents, apholate, tepa and metepa were obtained through the courtesy of Dr. A. B. Borkovec, in charge, chemosterilant investigations, USDA, Beltsville, Maryland.

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Experimental procedure : 0.25% and 0.5% solutions of the three chemosterilants were prepared in acetone. 5 c. c. of the desired solution was sprayed on each petri dish, 3 inches in diameter. The dish was continuosly rotated on the surface until dry and in this way an even film of the chemosterilant was obtained. Freshly emerged adults were released in between the two treated petri dishes for the desired period of time and were then transferred to clean glass jars. Virginity of adults was self insured as copulation always started at least two days after emergence. Sexing was, therefore, done only after treatments and single pair reciprocal crosses were established between treated and normal males and females and also between treated males and females. Five pairs of each type were observed for the rate of oviposition and the fertility of eggs. Per cent sterility and per cent net sterility was calculated by the following formula :

$$\frac{\text{Total number of unhatched eggs}}{\text{Total number of eggs laid}} \times 100 = \% \text{ sterility}$$

$$\frac{\%\text{ sterility in test} - \%\text{ sterility in normal}}{100 - \text{sterility in normal}} \times 100 = \% \text{ net sterility}$$

Results

The results obtained (Tables 1-3) show that all the chemicals could produce sterility in *D. cingulatus* but apholate was the most effective of the three chemosterilants tested.

The males when exposed to dishes treated at the rate of 1.77 mg/sq. inch of apholate for 30 minutes and mated with normal females induced 31.8% net sterility as against 27.4% net sterility obtained in the case of tepa treated males and 9.77% in case of males treated with metepa. The rate of sterility increased when the males were exposed for a longer period and 63.6, 44.4 and 49.7 % net sterility was observed in the eggs laid by normal females after having mated with males that had been exposed to apholate, tepa or metepa for two hours. The sterility was still higher when the males after having been exposed for two hours to 3.54mg/sq. inch of the chemosteri-

Table 1. Effect of apholate on the fecundity and fertility of *D. cingulatus*.

Concentration mg/sq. inch	Exposure period hours	Sex treated	No. of eggs laid			% Net sterility
			Average	Extremes		
1.77	0.5	Male	124.0	88	164	31.8
1.77	0.5	Female	89.0	43	119	10.9
1.77	0.5	Both	89.0	27	158	47.2
1.77	1.0	Male	124.4	56	212	39.3
1.77	1.0	Female	112.6	77	152	22.9
1.77	1.0	Both	88.2	69	129	60.7
1.77	2.0	Male	100.4	79	153	63.6
1.77	2.0	Female	101.0	60	117	42.8
1.77	2.0	Both	59.4	23	127	56.01
3.54	0.5	Male	124.4	92	150	35.5
3.54	0.5	Female	111.6	57	209	16.7
3.54	0.5	Both	77.6	42	112	53.1
3.54	1.0	Male	67.8	21	93	43.8
3.54	1.0	Female	112.4	81	148	20.6
3.54	1.0	Both	158.2	125	192	76.6
3.54	2.0	Male	114.0	38	185	97.5
3.54	2.0	Female	79.8	46	118	35.2
3.54	2.0	Both	46.2	22	79	100.0

Table 2. Effect of tepa on the fecundity and fertility of *D. cingulatus*

Concentration mg/sq. inch	Exposure period in hours	Sex treated	No. of eggs laid			% Net sterility
			Average	Extremes		
1.77	0.5	Male	208.4	171	236	27.4
1.77	0.5	Female	115.5	45	195	5.2
1.77	0.5	Both	178.5	111	237	38.3
1.77	1.0	Male	202.2	152	251	28.6
1.77	10	Female	164.7	109	258	15.4
1.77	1.0	Both	109.2	46	172	54.6
1.77	2.0	Male	202.5	197	208	44.4
1.77	2.0	Female	135.7	114	156	33.5
1.77	2.0	Both	89.7	41	131	75.05
3.54	0.5	Male	125.8	98	160	40.3
3.54	0.5	Female	186.3	168	244	18.6
3.54	0.5	Both	159.0	87	225	39.9
3.54	1.0	Male	148.0	109	232	47.5
3.54	1.0	Female	192.7	141	295	30.3
3.54	1.0	Both	178.7	114	226	53.4
3.54	2.0	Male	136.0	72	213	63.5
3.54	2.0	Female	189.0	149	250	37.6
3.54	2.0	Both	129.3	105	235	66.5

Table 3. Effect of metepa on the fecundity and fertility of *D. cingulatus*.

Concentration mg/sq. inch	Exposure period in hours	Sex treated	No. of eggs laid			% Net sterility
			Average	Extremes		
1.77	0.5	Male	95.0	48	172	9.77
1.77	0.5	Female	109.5	51	250	1.4
1.77	0.5	Both	101.4	43	132	37.9
1.77	1.0	Male	127.0	82	137	39.3
1.77	1.0	Female	107.2	36	172	21.4
1.77	1.0	Both	129.7	68	181	46.3
1.77	2.0	Male	95.5	62	136	49.7
1.77	2.0	Female	130.4	46	217	28.9
1.77	2.0	Both	93.5	46	142	72.4
3.54	0.5	Male	147.5	112	201	24.2
3.54	0.5	Female	93.2	77	123	9.4
3.54	0.5	Both	121.6	46	183	33.5
3.54	1.0	Male	95.6	52	131	39.3
3.54	1.0	Female	121.7	82	183	14.7
3.54	1.0	Both	120.2	76	173	38.5
3.54	2.0	Male	174.2	106	304	49.7
3.54	2.0	Female	75.0	48	132	30.3
3.54	2.0	Both	98.7	69	113	59.7

lant were allowed to mate with normal females.

Females were less affected than the males as far as the hatchability of eggs was concerned. A net sterility of only 35.2% was observed in the eggs laid by females exposed to 3.54 mg/sq. inch of apholate for two hours and mated with normal males as compared to 97.5% net sterility where only males had been treated at the same concentration and exposure period. Treatment of both the sexes added up the sterility effect and a higher sterility was observed in all such cases.

Mustafa and Naidu (1964) exposed the adults of *D. cingulatus* to petri dishes treated with apholate and found that the degree of sterility varied with the concentration of apholate and the exposure time. It was also found that more eggs were laid by the females that were mated with males exposed to a surface containing 0.35 mg/sq. inch than by the females mated with males exposed to a surface containing 1.4mg/apholate/sq. inch. A considerable reduction in oviposition was also observed when the females were exposed to a surface containing 0.7 mg. apholate/sq. inch for 18 hours. A similar reduction in the number of eggs laid by chemosterilized females had been observed by Morgan and LaBrecque (1962) in the case of *Musca domestica*. The present author, however, could not find any such reduction in the number of eggs laid by the females of *D. cingulatus* when chemosterilized with apholate, tepa or metepa.

Summary

The efficiency of apholate, tepa and metepa as chemosterilants of *D. cingulatus* was investigated. The freshly emerged adults were exposed in between the two petri dishes treated with 1.77 and 3.54 mg./sq. inch of three chemicals. The single pair reciprocal crosses were made between the treated and normal males and females and also between treated males and females. The apholate was found to be most promising out of the three chemicals tested. The rate of sterility increased with an increase in the exposure period and concentration of the chemicals. The males were more affected by the sterilizing action of the chemicals as compared with females. A net sterility of 100.0% was observed when both the sexes were exposed to a surface containing 3.54 mg. apholate/sq. inch for two hours.

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References

Baumhover, A. H. et al.: *J. Econ. Entomol.* 48, 462 (1955)

Creighton, C. S. et al.: *J. Econ. Entomol.* 59, 163 (1966)

Ezueh, M. I. and R. A. Hoopingarner : *J. Econ. Entomol.* 69, 907 (1967)

Hedin. P. A. et al.: *J. Econ. Entomol.* 57, 270 (1964)

Knipling, E. F.: *Bull. Ent. Soc. America* 12, 7 (1966)

Knipling, E. F.: *Science* 130, 902 (1959)

Mason, M. C. and F. F. Smith : *J. Econ. Entomol.* 60, 1127 (1967)

Morgan, P. B. and G. C. LaBrecqe : *J. Econ. Entomol.* 55, 626 (1962)

Mustafa, M. and M. B. Naidu : *Ind. J. Exp. Biol.* 2, 55 (1964)